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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,060	02/04/2004	Kang Sub Yim	AMAT/7034.P1/DSM/LOW K/JW	5473
44257	7590	04/14/2005	EXAMINER PADGETT, MARIANNE L	
MOSER, PATTERSON & SHERIDAN, LLP/ APPLIED MATERIALS, INC. 3040 POST OAK BOULEVARD, SUITE 1500 HOUSTON, TX 77056			ART UNIT 1762	PAPER NUMBER

DATE MAILED: 04/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/773,060	Applicant(s) YIM ET AL.	
	Examiner Marianne L. Padgett	Art Unit 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2004.
 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
 5) ☐ Claim(s) _____ is/are allowed.
 6) ☒ Claim(s) 1-20 is/are rejected.
 7) ☒ Claim(s) 7 is/are objected to.
 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3/29/04</u> | 6) <input type="checkbox"/> Other: _____ |

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1. Claim 7 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim 7 is dependent on itself, and as such is essentially unexamined. Considered alone, it would be noted to require the presence of 2 major components of air, or considered in context of the listing, it's probably a typographical error, and would logically be dependent from claim 6, but this is not what is claimed.

2. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Use of relative terms that lack clear metes and bounds in the claims, or in a definition in the specification or in cited relevant prior art, is vague and indefinite. In all the independent claims 1, 11, and 17, see "low" in "low dielectric constant". While the phrase is used throughout the specification, with various examples being given, an example is not a definition, and no clear definition of the limits of this term was found in the specification.

Lacking proper dependence, claim 7 has no clear actions that constitute a "method".

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 1010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground

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provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-20 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 5, 7, 10-13, 16-26 and 29-30 of copending Application No. 10/302,393. Although the conflicting claims are not identical, they are not patentably distinct from each other because the 2 sets of claims have overlapping ranges, where all the features present in the instant claims may be found in some

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combination in the application of 302,393. For example, as indicated by claims 11-12, alpha-terpinene is a species of the illustrated structure and reads on R = methyl from present claim 14, so these claims have overlapping scope with this term. While the (393) independent claims do not require the organosilicon compound to be O-free and linear, claimed species thereof such as trimethylsilane have both characteristics, and is explicitly claimed in the instant cases. In (393) oxidizing gases, possibly 2 or more, are required in various combinations of claims. The copending case differs by requiring particular hardness and/or dielectric constants after deposition and EB curing, but as this case goes through the same stages with less detail, it totally encompasses the (393) case limitations, hence constitutes obvious variations thereof.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

5. In the claims, it is noted that the language “comprising one ring and one or two carbon-carbon double bonds in the ring” (emphasis added) will read on (1+) C=C being present, i.e., 1, 2, 3, or more C=C, as well as 1 or more rings due to the open comprising language, thus the claim language as written is inclusive of hydrocarbons with an aromatic rings(s), etc. Also note that the “mixture comprising...” means that if there are multiple Si precursors only one need be both liner and oxygen free, but other precursors can have any of the excluded features.

6. Claims 1-8 and 17-18 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims (1-3, 17, 18 & 20) or (1-2, 4-5, 14, 16, 20-24, 26-31, 33 & 36) of copending Application No. 10/302,375 or 10/428,374, respectively. Although the conflicting claims are not identical, they are not patentably distinct from each other because the applications have overlapping ranges of

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deposition materials, with the (375) or (374) cases suggesting gas mixtures that may contain all the components claimed, noting as per the comments in section 5 above, that 1, 1, 3, 3-tetramethylbutyl benzene has a cyclic component of the requisite number of carbon and C=C. While (375) or (374) differ by requiring more extensive limitations on EB exposure and possible PECVD processes or by additional precursor compounds, the broader limitations of the present claims encompass these narrower limitations, hence these claims are considered obvious variations with overlapping ranges of limitations.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

7. Copending cases of interest include 10/115,832, 10/353,379 and 10/409,887 are depositing low dielectric constant materials from related gas mixtures, however when they recite hydrocarbons, they are aliphatic not cyclic and unsaturated in any rings.

8. Claims 1-6 and 8 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Grill et al (6,312,793 B1).

Grill et al (793) teach depositing a low dielectric constant film, deposited using a plasma CVD process, that may be post-deposition anneal, and where the gaseous precursors may consist of methylsilanes, such as trimethylsilane, and an oxidizing agent (O₂ or N₂O), plus a second precursor mixture that may have cyclic hydrocarbons, such as cyclohexane, norboranadiene (i.e. bicycloheptadienes) or aromatics, such as benzene or xylenes (i.e. dimethyl benzene). In Grill et al, see the abstract; col. 3, lines 13-53; col. 4, lines 10-22; col. 6, lines 18- 53; Ex.4 on col. 8, lines 40-47; and col. 9, lines 43-67.

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9. Claims 9-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grill et al as applied to claims 1-6 and 8 above, and further in view of Wakizaka et al (6,270,900B1).

While Grill et al teach cyclic hydrocarbons in general, including unsaturated and -diene examples, they do not disclose α -terpinene nor the more general alkyl isopropyl-cyclohexadiene structure of claim 11, however Wakizaka et al, who is also making dielectric films that may be used with semiconductor wiring (col. 1, lines 4-15) employs unsaturated hydrocarbons (cycloalkenes), where equivalently useful structure include norbornene rings and derivatives, cyclopentadiene and derivatives, cyclic conjugated dienes, such as 1,3-cyclohexadiene, etc., and modified products of these materials, where adding functional groups that include alkyl substitutions of 4-20 C (col. 3, line 36-col. 5, lines 40, esp. col. 4, lines 1-15 and 64-col. 6, line 8; and col. 6, line 57-col. 7, line 3). It would have been obvious to one of ordinary skill in the art that given the general and specific teachings of cycloalkene compounds in Grill et al, and the showings of overlapping and equivalent cycloalkenes in Wakizaka et al, that compounds suggest therein, such as 1,3-cyclohexadiene and modifications and deviations thereof would have been expected to be effective in Grill et al's process, since they have been shown to have analogous ring opening behavior or chemistry, especially considering at present no particular chemical results is required in the claims. Also, Wakizaka et al compositions may also contain silyl compound, such a chlorodimethylvinyl silane (col. 8, lines 15-17 and col. 1, lines 1-9 for further related chemistry).

10. Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grill et al (793) as applied to claims 1-6 and 8 above, and further in view of Goo et al (6,657,251) or Ross (6,271,146 B1).

Claims 16 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grill et al (793) in view of Wakizaka et al as applied to claims 1-6 & 8-15 above, and further in view of Goo et al or Ross (146).

These claims differ from the primary reference by requiring a post deposition treatment with electron beam, while Grill et al (793) teaches thermal annealing. The patents to Goo et al (abstract; fig. 2-3; col. 1, line 56-col. 2, lines 10 and 44-55; col. 3, lines 14-36 and 56-col. 4, line 30), or Ross (Abstract; col. 2, lines 33-47 & 52-67+; col. 4, lines 29-67+; col. 5, lines 31-44+) teach various CVD and plasma CVD processes for analogous dielectric materials, where post-treatment with EB to produced a superior films is shown. In Goo et al, the figures 2-3 compare k before verses k after EB treatment for different CVD techniques, and thermal verse EB, to show the general effectiveness and superiority of using electron beam post-treatment. Ross (146) teaches that EB desirably reduces the level of H in oxide films (both CVD and PECVD, etc originated), which reduces the potential to interact with moisture, thus leads to a more stable film. For either of these sets of reasons, it would have been obvious to one of ordinary skill in the art to employ election beam post-treatment instead of thermal for advantages it has been shown to provide to analogous films.

Also while Grill et al disclose use of oxidizing agents, with O₂ particularly suggested, and transport of gas mixtures by inert gases, with He or Ar mentioned, they do not disclose the specific combination of O₂ + CO₂, however carbon dioxide while O-containing is less reactive, so is sometimes used as a "inert" or non-reactive gas, and with the compositions of Grill et al., CO₂ contains no contaminates being made of elements to be deposited, hence would have been an obvious alternate choice for a carrier gas as it would be expected act as an inert gas out of the

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plasma environments, so would not cause premature reaction (the purpose of a carrier gas), but would potentially contributed to the oxidizing environment in the plasma without being a potential contaminate source when combined with the more reactive O₂. One of ordinary skill would have been expected to be aware of such basic chemistry, and economics, i.e. relative cost of different inert gases may also be a motivating factor for use.

11. Other art of interest include Leu et al (6,605,549 B2) and Ross et al (6,582,777 B1) with more teachings on the use and advantages of EB post-treatment. Lang et al (6,709,715 B1) has gas combinations for PECVD of interest (xylene + trivinylmethylsilane), but does not teach combining with oxidizing gas, while Vrtis et al (2003/0232137 A1 and 2004/0197474 A1) teach α -terpinene + tri- or tetra-methylsilane, but are not prior art.

12. Claims 1-6 & 8 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-2, 5, 6, 8, 10-12, 14, 20 and 22-23 of U.S. Patent No. 6,797,643. Although the conflicting claims are not identical, they are not patentably distinct from each other because like in section 6 above, the claims of this copending patent (643) may comprise all the claimed gases, noting that again the tetramethyl butyl benzene reads on the claimed hydrocarbon as written, and the broader present claims encompass the (643) case's narrower claims.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M L. Padgett whose telephone number is (571) 272-1425. The examiner can normally be reached on Monday-Friday from about 8:30 am to 4:30 pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached at (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M. L. Padgett/af
March 31, 2005
April 13, 2005

A handwritten signature in black ink, appearing to read "Marianne Padgett", with a large, stylized initial "M" and "P".

**MARIANNE PADGETT
PRIMARY EXAMINER**